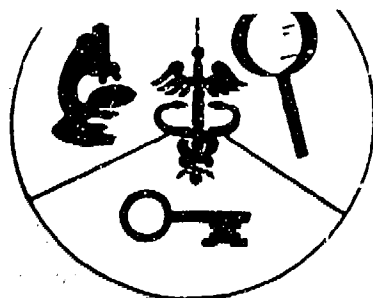AD-A278 041

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AMBULATORY CARE GROUPS

AN EVALUATION FOR

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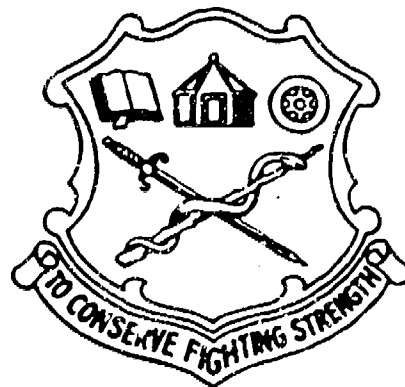
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The Ambulatory Care Evaluation Study (ACES) team, part of the U.S. Army Health Care Studies and Clinical Investigation Activity, evaluated the Ambulatory Care Groups (ACGs) System developed at Johns Hopkins University for possible military use. The ACGs are unique in that they were developed to categorize patients or populations rather than visits or services. The ACGs categorize diagnoses according to their likelihood of persistence. They are conceptually simple and require only *patient age, gender and ICD-9-CM diagnoses* over the period of time under study. The ACGs are based on 34 broad clusters of ICD-9-CM diagnoses called ambulatory diagnostic groups (ADGs). The ACGs were developed from enrolled population data during a one-year time period. The ACG developers made three specific claims about the ACG grouper performance: First, 30-50% of the variance in number of visits and ambulatory charges can be explained by the ACG designation.

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Second, the ACG grouper is twice as powerful in predicting
resource use in the same year of morbidity than in the subsequent
year of utilization (the ACGs explained over 20% of the variance
in visits and ambulatory charges in the subsequent year). Third,
the number of unique ADGs explain up to 50% of the variance in
utilization for the year in which they were assigned and up to
42% of the variance in charges for the year of assignment. The
ACG developers do not recommend the grouper as an appropriate
tool for making individual decisions about the financial impact
of a single patient's health status. The ACG grouper system is
recommended for application to research as well as payment and
management of Medical Service.

The ACES team's evaluation of the ACGs addressed the
following four issues: (a) clinical evaluation, (b) user
friendliness (programming and administrative issues), (c)
statistical analyses of the grouper results, and (d) military
applicability.

The team found that the ACG groups are conceptually sound.
However, there were some problems with the grouper algorithm in
the pilot version evaluated by the study group. The pilot
version of the ACGs used over 5,000 common ICD-9-CM diagnoses in
the grouping algorithm. The ACG grouper algorithm should be
modified to assign the majority of ICD-9-CM diagnoses to
ambulatory diagnostic groups (ADGs). The limited list of ICD
codes used resulted in an underestimation of morbidity levels.
There are also some inconsistencies in the assignment of
diagnoses to major, versus minor, ADG categories. For example,
the assignment of psychiatric diagnoses to ADGs 23 and 24 should
be revised because minor psychiatric conditions are assigned to
the ADG for Psychosocial: major. The titles of ACGs arising from
Major Ambulatory Categories (MAC) 10, 17, 21, and 23 should be
revised, as the use of the term psychosocial to describe
psychophysiologic conditions is misleading.

The ACG grouper is available in a personal computer or
mainframe version. Both versions were used on a test file and
provided the same results. The ACES team used a 12-month sample
of data containing 774,750 patient records representing 260,515
unique patients (called the Year Sample) to evaluate the ACG
grouper. The mainframe version was used for the evaluation of
the Year Sample because it rapidly processed the large sample.
The input data had to be sorted by patient ID and the output was
an ACG code per unique patient. The grouper appeared to
appropriately group all patient records presented to it.
Analyses of variance (ANOVA) procedures were performed to assess
the relationship between the ACG category and a variety of

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19. ABSTRACT:

dependent variables which included using ACES cost formulas and
logarithmic cost, total number of ambulatory visits, and total
number of diagnoses made in the year. These results are in Table
A Costs (including Logarithm Cost).

TABLE A: Summary of Total Variance Explained by ACGs

DEPENDENT MEASURES

	NUMBER OF VISITS	COSTS	LOGARITHM COSTS	# DIAGNOSES
51 ACGs SAME YEAR	0.50	0.35-0.44	0.43-0.47	.71

These r-squares approximate the r-squares reported by the
ACG developers. The ACG grouper explains approximately 50% of
the variables in number of visits, from 35% to 44% of the
variance in costs and 43% to 47% of the variance using
logarithmically transformed costs in the year studied and 71% of
the variance in the number of diagnoses (roughly equivalent to
the level of morbidity).

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APPENDIX

EXECUTIVE SUMMARY

The Ambulatory Care Evaluation Study (ACES) team, part of the U.S. Army Health Care Studies and Clinical Investigation Activity, evaluated the Ambulatory Care Groups (ACGs) System developed at Johns Hopkins University for possible military use. The ACGs are unique in that they were developed to categorize patients or populations rather than visits or services. The ACGs categorize diagnoses according to their likelihood of persistence. They are conceptually simple and require only *patient age, gender and ICD-9-CM diagnoses* over the period of time under study. The ACGs are based on 34 broad clusters of ICD-9-CM diagnoses called ambulatory diagnostic groups (ADGs). The ACGs were developed from enrolled population data during a one-year time period. The ACG developers made three specific claims about the ACG grouper performance: First, 30-50% of the variance in number of visits and ambulatory charges can be explained by the ACG designation. Second, the ACG grouper is twice as powerful in predicting resource use in the same year of morbidity than in the subsequent year of utilization (the ACGs explained over 20% of the variance in visits and ambulatory charges in the subsequent year). Third, the number of unique ADGs explain up to 50% of the variance in utilization for the year in which they were assigned and up to 42% of the variance in charges for the year of assignment. The ACG developers do not recommend the grouper as an appropriate tool for making individual decisions about the financial impact of a single patient's health status. The ACG grouper system is recommended for application to research as well as payment and management of Medical Service.

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INTRODUCTION

In the early 1980s' concerns about cost control and quality of care were largely focused on inpatient care. Congressional concerns over spiraling Medicare inpatient expenses led to the authorization of a Prospective Payment System (PPS) for Medicare inpatient hospital services. The Diagnostic Related Groups (DRGs) was the patient classification system selected by the Health Care Finance Administration to serve as the PPS. The PPS was implemented in 1983 and general hospitals began applying the DRGs to define their case mix and to make prospective estimates of resource consumption (costs) per case. While inpatient utilization rates and lengths of stay decreased, the utilization rates for ambulatory services underwent a dramatic increase as patient care shifted to the outpatient setting. Medicare expenditures for hospital-based outpatient care grew 17% a year from 1986 to 1989. Medicare reimburses hospitals for ambulatory health care based on aggregate departmental charges which are used to determine prevailing rates. Reimbursement mechanisms have not required the determination of actual cost; therefore, the hospital and the payer have had little understanding of the cost of an ambulatory visit.

The success of the inpatient PPS in decreasing Medicare expenditures prompted Congress to pass the Omnibus Budget Reconciliation Act (OBRA) in 1986 which instructed the Health Care Financing Administration (HCFA) to develop a PPS for hospital-based outpatient care. In 1987, Congress directed the Department of Defense (DOD), through the National Defense Authorization Act, 1987, (P.L. 99-661 Sec 701, USC 1101), to revise the method of allocating resources in the military health care system. The Act specified that DOD uses a DRG-type system to allocate resources to its medical treatment facilities. The system was to be implemented October 1, 1987, for inpatient care and October 1, 1988, for outpatient care. By 1989 there was still no nationally accepted ambulatory system available for implementation. Therefore, congress, in subsequent National Defense Authorization Acts, extended the deadline for the outpatient system to 1 October of 1995.

The development of a prospective payment system for the ambulatory care setting is much more difficult than for inpatient health care. Historically, ambulatory care reimbursement has been based on fee-for-service. Ambulatory care occurs in a variety of settings and involves many more providers. Some of the problems encountered in the study of ambulatory care involve the following: the beginning and endpoint of care are ill-defined; care often involves many diagnoses over time; one ambulatory visit may prompt referrals and diagnostic tests which occur in other settings; bills are generated from multiple sites; and data bases are poorly developed to link referrals, ancillaries, and all visits over time for a particular patient.

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Several ambulatory classification systems have been developed in recent years. Three of the more well known case mix systems are largely visit- or service-based, and were developed under HCFA grants. These are the Ambulatory Visit Group System (AVGs), developed at Yale University, the Products of Ambulatory Surgery/Products of Ambulatory Care (PAS/PACs), developed by the New York State Department of Health, and the Ambulatory Patient Groups (APGs) developed by Health Systems International, now 3M-HTS. The Ambulatory Care Groups (ACGs), developed at Johns Hopkins University, categorize patients or populations rather than individual visits or services.

ACG DEVELOPMENT

The Ambulatory Care Groups (ACGs) were developed by Starfield, Weiner, and colleagues at Johns Hopkins University under a grant from the Agency for Health Care Policy and Research. The ACGs are unique in the field of ambulatory patient classification systems in that they were developed to provide a person-oriented measure to explain levels of morbidity and associated ambulatory health care resource consumption. The developers noted that "at present, prospective pricing is hampered by the lack of an acceptable method of specifying differences in medically related needs of enrolled populations." Current approaches to setting rates for capitation have major limitations. In Medicare's AAPCC (average adjusted per capita cost) method, the projected national average cost per capita for all Medicare beneficiaries is calculated and then adjusted for variations in cost across geographic areas. Projected costs for a HMO are calculated by adjusting this figure according to age, sex, institutional status (e.g., nursing home), and Medicaid or non-Medicaid. This method has been found to predict costs poorly (Anderson et al., 1986a), and to perpetuate inefficiencies in existing practice." (Starfield, HSR April 1991)

The ACGs categorize diagnoses according to their likelihood of persistence. The development of the Diagnostic Related Groups (DRGs) provided a general model for the development of the Ambulatory Care Groups. The length of hospital stay was the key measure used to construct the DRGs. The key dependent measure for ACG development was the number of ambulatory visits a person made during an extended period of time, such as one year.

The ACGs are conceptually simple. They require patient age, sex, and ICD-9-CM diagnoses assigned during patient-provider encounters over the period of time under study. These variables are routinely collected on records and insurance claim systems. The ACGs are based on broad clusters of ICD-9-CM diagnoses, not on specific diagnoses which may change over time. The ACGs place approximately 5,000 common ICD-9-CM codes into one of 34 clusters called ambulatory diagnostic groups (ADGs). The ACG grouping process involved four stages of categorization.

1) Every ICD-9-CM code was assigned into one of 34 ambulatory diagnostic groups (ADGs); (See Appendix A)
2) Similar ADGs were "collapsed" into 12 collapsed ADGs (CADGs); (See Appendix B)
3) Based on a person's constellation of CADGs, he/she was placed into one of 25 mutually exclusive major ambulatory categories (MACs); (See Appendix C)
4) Based on age, sex, presence or absence of certain individual ADGs, and number of individual ADGs, persons within some MACs were further partitioned. Ultimately, each person was categorized into one of 51 mutually

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exclusive ambulatory care groups (ACGs). (Medical Care, May 1991, Vol 29, No. 5) (See Appendix D)

The theoretical goal of ADG assignment was to cluster together similar conditions based on their expected resource consumption. "In relative order of importance, the clinical criteria that guided the process of clustering different conditions into ADGs were as follows":

1) The expected persistence/recurrence of a condition over time;
2) The likelihood that the patient would make a return visit to continue treatment for a condition;
3) The likelihood that a specialty referral would be required;
4) The expected need and cost of diagnostic and therapeutic procedures associated with a condition;
5) The likelihood that the patient would require hospitalization for a condition during the near term;
6) The likelihood that a condition would result in either short-term or long-term disability; and
7) The likelihood that a condition would lead to decreased life-expectancy, either over the short or long term." (Weiner, Medical Care, May 91).

The ACG system was developed and tested using computerized encounter and claims data from five "enrolled" population groups (four HMOs and the Maryland Medicaid program) which contained more than 160,000 continuous enrollees. The Yale AUTOGRP program was used to identify subgroups of enrollees possessing the lowest possible within groups' variation in ambulatory resource consumption as measured by visit rate. The ACG developers found that over 30%, and in some cases, well over 50% of the variance in number of visits and ambulatory charges were explained by the ACG designation. The ACG grouper was twice as powerful in predicting resource use in the same year of the morbidity than in the subsequent year of utilization. The ACGs explained over 20% of the variance in visits and ambulatory charges in the subsequent year. "Although the coefficients of variation for some of the ACG categories tend 1 to be relatively high (.8 or more), for some types of diagnoses (especially chronic medical conditions both stable and unstable, and major psychosocial diagnoses), most coefficients were in the range of .4-.7. A notable exception was the Medicaid population where coefficients of variation were uniformly higher than for the populations enrolled in the HMOs." (Starfield, HSR April 91)

The ACG developers found that individuals with psychosocial diagnoses, whether alone or in combination with other types of diagnoses, have relatively high levels of utilization as do infants under age 2, and individuals with multiple types of morbidity (multiple ADGs). "By explicitly recognizing

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combinations of types of disorders, the ACG system serves as a measure of 'case-mix' at the individual level as well as at the population level." (Starfield, HSR April 91)

The ACGs are not recommended as an appropriate tool for making individual decisions about the financial impact of a single patient's health status. The ACGs were developed to have applicability to research as well as payment and management. For example, the developers of the ACGs suggest that the grouper may be used for the assessment of outcomes across providers, studies of medical practice variations and utilization, and as a management tool to tailor payment levels to differences in levels of morbidity.

EVALUATION OF THE AMBULATORY CARE GROUPS
Methodology
Sample

An effective evaluation of any ambulatory classification system is best accomplished through the use of a large ambulatory patient sample containing diversity in terms of age, gender, diagnoses and procedures. The ACES team utilized a sample from the Army Medical Department's Ambulatory Care Data Base Study (ACDB), Georgoulakis et al (1988). The ACDB data collection phase spanned a 21-month period and contains data on visits from all ambulatory clinics at six study hospitals. Over 3.1 million patient visits were recorded representing care provided by more than 4,000 health care providers across all outpatient specialties.

Diagnostic and Procedural Code Recoding

The original purpose of the ACDB was not for the evaluation of civilian developed classification systems. It was part of the Tri-Service Performance Measurement Study (PMS) whose purpose was to develop an alternative method of measuring military medical work units. Although the diagnostic and procedure codes of the ACDB study were based on the International Classification of Diseases 9th Revision Clinical Modification (ICD-9-CM) and Physicians' Current Procedural Terminology Fourth Edition (CPT-4), the physician/provider advisory panel to the ACDB study recommended the use of additional codes to allow more definition of procedures and diagnoses. These were called "extended codes." For example, Nutrition Care is a nonphysician specialty clinic included in the ACDB. Because CPT was written for physicians there were no codes to describe nutritional assessments and counseling. Another example is that the military health system provides physical exams for different purposes such as flight physicals and "over 40" physicals which involve several different CPT procedures. Extended procedure codes such as "flight physical" were created to facilitate data entry. For the ACDB to be useful for the purpose of evaluating ambulatory patient classification systems, the extended codes had to be recoded to conventional ICD-9-CM and CPT-4 codes. This recoding was an iterative process. Under contract, two civilian health care information companies recoded the extended diagnosis and procedure codes to ICD-9-CM and CPT-4 standards. All codes used in the study (ICD-9-CM, CPT-4, and Code extenders) were independently reviewed by the physicians on the study team. The physicians found multiple errors in the mapping of extended codes by these companies, most notably the procedure codes. These physicians found it difficult to accurately code many procedures performed in specialty clinics outside their own area of training. Under the direction of the study team senior medical consultant, clinical consultants from the various specialties assisted in recoding these procedures. Clinical department

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chiefs at Brooke Army Medical Center (BAMC) provided most consultations. The proximity of BAMC simplified in-person and telephonic consultations. Many of the consultants were unfamiliar with CPT-4 codes, so they provided information that the staff physicians used to recode the extended procedure codes. This method of code selection offered greater uniformity and reduced specialty bias in the recoding process. Most Nutrition Care extended procedure codes were mapped to office visits using time to determine if visit was brief, limited, extended, etc.

The difficulties encountered in the coding of diagnoses and procedures made it very clear that accurate coding is best performed by the health care provider. In our experience retrospective coding by other physicians resulted in errors while the contract coding specialists made many errors. For further information about the ACDB study to include test sites, data collection and reliability studies, the reader is referred to The Army Ambulatory Care Data Base (ACDB) Study: Implementation and Preliminary Data September 1988, (Georgoulakis et.al. 1988).

For the purposes of evaluating the ACGs, 774,750 recoded patient records (visits) from a twelve-month period in the middle of the ACDB collection phase were selected. The study group decided against using early data because of the errors associated with the "startup" process. These 774,750 records were sorted by patient identification code to produce 260,515 unique patient episodes, which was called the "Year Sample". The "Year Sample" (n=260,515 unique patients) was further examined. Demographic characteristics of the Year Sample are presented in Table 1.

TABLE 1: Demographic Characteristics Of The Year Sample

DEMOGRAPHIC CHARACTERISTICS	PATIENT VISITS		UNIQUE PATIENTS (POPULATION SAMPLE)	
	NUMBER	PERCENT	NUMBER	PERCENT
SEX:				
Female	353545	45.63	112264	43.09
Male	421205	54.37	148251	56.90
TOTAL	774750	100.00	260515	100.00
AGE:				
0-1	34318	4.42	11006	4.22
2-5	32036	4.13	13058	5.01
6-16	59987	7.74	25700	9.86
17-34	423685	54.68	137664	52.84
35-44	76302	9.84	26233	10.06
45-64	108331	13.98	36214	13.90
65 +	40091	5.17	10640	4.08
TOTAL	774750	*100.00	260515	* 100.00
BENEFICIARY STATUS:				
Military Active Duty	298158	38.48	89070	34.18
Family Member	245463	31.68	82918	31.82
Retiree	70005	9.03	20604	7.90
Other	161124	20.79	67923	26.07
TOTAL	774750	* 100.00	260515	* 100.00

* includes rounding

Of the 774,750 visits in the sample, 421.205 (54.37%) were by
males and 353.545 (43.09) were by females. As noted in Table 1
the sample of visits represent literally all age groups.
Additionally as depicted in the table the active duty military
utilized slightly more than a third of the total care provided.
The year sample was run through transition to Table 3.

The Year Sample was run through the mainframe version of the ACG grouper. The results of the grouper presented are in Table 2.

TABLE 2: Distribution Of Ambulatory Care Group Assignments

ACGs Group Number	Frequency	Percent	Ambulatory Care Groups (ACGs) Title or Description
1	2633	1.0	Acute Minor, Age<2
2	3110	1.2	Acute Minor, Age 2-5
3	51021	19.6	Acute Minor, Age 6+
4	18577	7.1	Acute Major
5	24370	9.4	Likely to recur w/o Allergies
6	2148	0.8	Likely to recur with Allergies
7	849	0.3	Asthma
8	3574	1.4	Chronic Medical, Unstable
9	8138	3.1	Chronic Medical, Stable
10	1743	0.7	Cnronic Specialty Stable
11	6901	2.6	Ophthalmological/Dental
12	1446	0.6	Chronic Specialty, Unstable
13	4007	1.5	Psychosoc, w/o Psych. Major
14	3649	1.4	Psychosocial, w/Psych-Maj, w/o Psych-Min
15	547	0.2	Psychosocial, w/Psych-Maj, w/Psych-Min
16	31194	12.0	Preventive/Administrative
17	5589	2.1	Pregnancy
18	12046	4.6	Acute Minor + Acute Major
19	1395	0.5	AcuteMI + LRDis, Age <2
20	1316	0.5	AcuteMI + LRDis, Age 205
21	12449	4.8	AcuteMI + LRDis, Age>5 w/o Allergy
22	926	0.4	AcuteMI + LRDis, Age>5, w/ Allergy
23	2140	0.8	Acute Minor + Med Stable
24	2518	1.0	Acute Minor + Eye/Dental
25	1299	0.5	Acute-Min + Psychosoc, w/o Psych-Maj
26	1053	0.4	AC-Min + Psychosoc, w/ Psych-Maj, w/o Psych-Min

TABLE 2: (continued)

27	207	0.1	AC-Min + Psysoc, w/Psych-Maj, w/Psych-Min
28	3880	1.5	Acute Major + Likely to Recur Discrete
29	461	0.2	Acute MI Acute MA + LRDis, Age <2
30	382	0.1	Acute MI + Acute MA + LRDis, Age 2-5
31	306	0.1	Acute MI + Acute MA + LRDis, Age 6 11
32	5029	1.9	Acute MI + Acute LRDis Age>5 w/o allergy
33	315	0.1	Acute MI + Acute MA + LRDis, Age>5 w/allergy
34	906	0.3	Acute MI + LRDis + Eye/Dental
35	1266	0.5	Acute MI + LRDis + Psychosocial
36	743	0.3	Acute MI + Acute MA + LRDis + Eye/Dental
37	1070	0.4	Acute MI + Acute MA + LRDis + Psychosocial
38	3060	1.2	2-3 Other ADG Combos, Age <17
39	3582	1.4	2-3 Other ADG combos, Males Age 17-34
40	5051	1.9	2-3 Other ADG combos, Females Age 17-34
41	11317	4.3	2-3 Other ADG Combos, Age >34
42	1396	0.5	4-5 Other ADG Combos, Age <17
43	6557	2.5	4-5 Other ADG Combos, Age 17-44
44	3895	1.5	4-5 Other ADG Combos, Age> 44
45	230	0.1	6-9 Other ADG Combos, Age <6
46	174	0.1	6-9 Other ADG Combos, Age 6-16
47	1105	0.4	6-9 Other ADG Combos, Males Age 17-34
48	1365	0.5	6-9 Other ADG Combos, Females Age 17-34
49	2117	0.8	6-9 Other ADG Combos, Age >34
50	308	0.1	10+ Other ADG Combos
51	1155	0.4	No Visits and/or No ADGs

Table 3 presents a frequency distribution of the ACG assignments
in descending order.

TABLE 3: Frequency Distribution Of ACG Assignments

ACG	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
03	51021	19.6	51021	19.6
16	31194	12.0	82215	31.6
05	24370	9.4	106585	40.9
04	18577	7.1	125162	48.0
21	12449	4.8	137611	52.8
18	12046	4.6	149657	57.4
41	11317	4.3	160974	61.8
09	8138	3.1	169112	64.9
11	6901	2.6	176013	67.6
43	6557	2.5	182570	70.1
17	5589	2.1	188159	72.2
40	5051	1.9	193210	74.2
32	5029	1.9	198239	76.1
13	4007	1.5	202246	77.6
44	3895	1.5	206141	79.1
28	3880	1.5	210021	80.6
14	3649	1.4	213670	82.0
39	3582	1.4	217252	83.4
08	3574	1.4	220826	84.8
02	3110	1.2	223936	86.0
38	3060	1.2	226336	87.1
01	2633	1.0	229629	88.1
24	2518	1.0	232147	89.1
06	2148	0.8	234295	89.9
23	2140	0.8	236435	90.8
49	2117	0.8	238552	91.6
10	1743	0.7	240295	92.2
12	1446	0.6	241741	92.8
42	1396	0.5	243137	93.3

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19	1395	0.5	244532	93.9
48	1365	0.5	245897	94.4
20	1316	0.5	247213	94.9
25	1299	0.5	248512	95.4
35	1266	0.5	249778	95.9
51	1155	0.4	250933	96.3
47	1105	0.4	252038	96.7
37	1070	0.4	253108	97.2
26	1053	0.4	254161	97.6
22	926	0.4	255087	97.9
34	906	0.3	255993	98.3
07	849	0.3	256842	98.6
36	743	0.3	257585	98.9
15	547	0.2	258132	99.1
29	461	0.2	258593	99.3
30	381	0.1	258975	99.4
33	315	0.1	259290	99.5
50	308	0.1	259598	99.6
31	306	0.1	259904	99.8
45	230	0.1	260134	99.9
27	207	0.1	260341	99.9
46	174	0.1	260515	100.0

Tables 2 and 3 demonstrate that nearly 60% of the patient episodes were assigned to ACGs 3, 16, 5, 4, and 21. These ACGs are in order: Acute Minor, Age 6+, Preventive/Administrative, Likely to Recur with Allergies, Acute Major, Acute Minor + Likely to Recur Disease, Age > 5 without Allergy.

Limitations of Data Sample

There are limitations to the ACDB for use in the evaluation of the ACGs. The ACGs were developed from enrolled population data. It is necessary to have information about all ambulatory health care encounters and associated diagnoses for each patient to accurately assess the level of morbidity. The ACDB contains only information for ambulatory health care occurring within the military treatment facilities. Information regarding health care

outside the military system is not included. Some patients who received health care outside the military facility may have had more diagnoses than contained in the ACDB. These patients may have grouped to different ACGs if all information had been available. The ACDB data is fairly complete for active duty patients who are first priority for care within the military health care system and must obtain command-level approval for military reimbursed "supplemental" care outside the military health care system. The ACDB does not capture health care of nonactive duty beneficiaries who utilize CHAMPUS, Medicare/Medicaid or private insurance (CHAMPUS covers DOD beneficiaries until the age of 65 when Medicare coverage begins). Because nonactive duty beneficiaries are not reimbursed for the entire cost of ambulatory visits, there is an incentive to receive care at the military facility where there is no charge to the patient.

To the purpose of studying the case-mix of patient receiving care at military health care treatment facilities, the ACDB is a very adequate sample. Therefore it was not possible to link the ACDB to CHAMPUS data because the ACDB predates accessible CHAMPUS data. Accessible CHAMPUS data cannot be matched in time to any existing military database. Therefore it was not possible to assess all health care given to the military beneficiary population, as this would have required linking military, CHAMPUS, Medicare, Medicaid, and private insurance data.

It should also be remembered that the six Army medical treatment facilities vary in the types and number of providers assigned and thus the scope of available services varies from one site to the next. The data from the sites is combined to provide one sample. Separating the sites prior to grouping and cost analysis could give a profile of the variations in case-mix, practice and utilization patterns, and cost differences. However, such analyses were beyond the scope of the current study.

Cost Methodology

To accurately evaluate the various ambulatory classification systems, the development of an equitable per visit cost was necessary. This presented a significant challenge in that it required a comprehensive individual cost for each patient encounter (visit) in the ACDB data file.

The study team developed four different methods to approximate a visit cost. The development of the various methodologies was necessary because military hospitals do not use a civilian type cost methodology that is capable of producing a "bill" or more precisely a "cost" for each individual visit. Military hospitals are funded from various funding sources. For example, military pay and allowances are paid from a general fund

account and may be regarded as "sunk" costs in that they are paid to military health care providers regardless of the number of patients for whom they provide care. Civilian health care provider salaries and benefits are resourced from major command allocation of funds, balanced with authorized personnel ceilings. The MTF commanders, once given their allocations of personnel, have nominal authority to manage personnel and associated costs. Normal capital expenses, new buildings, and major equipment are provided subject to availability of funds from major commands or higher command levels and are not included in the hospital's operating budget.

Utilities are considered installation operating expenses and, as such, are not included in the hospital's operating budget. However, due to the increased emphasis on cost recovery for these and other services, these costs are now contained in the Medical Expense Performance Report System (MEPRS) at the MTF level. Finally, it was not possible for the study team to develop cost methodologies associated with indirect health care costs, such as provider malpractice insurance, forms, etc. Nevertheless, as the military adapts to new ambulatory costing and resource allocation methodologies, all inclusive expense data is vital to insure fair and equitable MTF funding.

Definitions of Cost Formula Components

The following are descriptions of the various components which make up the cost formulas:

ANCILLARY: For those laboratory procedures indicated by CPT procedure codes within the range of 80002-89399, a percentage of the CHAMPUS reimbursement rate was used. To arrive at this percentage, a military average for laboratory was calculated (total number of visits in the sample, 516,006, multiplied by the average per visit MEPRS laboratory reimbursement of $3.36). This total was divided by the actual number of laboratory procedures performed (152,982) to provide an average cost per procedure of $11.33. The average cost for all CHAMPUS laboratory procedures was $18.25. The percentage of military to CHAMPUS laboratory cost ($11.33/$18.25) was 62.1%. This percentage was applied to laboratory procedures.

CHAMPUS: These rates are based on the CHAMPUS prevailing rate for each CPT procedure. CHAMPUS prevailing rates are the amount of money paid on a total number of claims for a particular state. The claims are paid at the 80th percentile as the prevailing rate for the procedure in that state. The CHAMPUS prevailing rates in this study were the averages of the regional rates at the time of data collection. Additionally, the CHAMPUS prevailing rate consists of both a technical and a professional component. The technical component accounts for 60% of the prevailing rate and the professional component accounts for the remaining 40%.

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CLMEAN: An average procedure cost per clinic group was employed for calculating a military supply cost. This average was computed by taking the sum of all CHAMPUS procedure costs for a clinic grouping divided by the number of visits in that particular grouping.

FACCOMP: The facility component is obtained by using the following formula: AVERAGE PROCEDURE COST PER MINUTE MULTIPLIED BY PRIMARY PROVIDER TIME. The average procedure cost (AVGPROC COST) is 60% of the sum of the procedure costs for all visits within a clinic grouping divided by the sum of the providers' time for all visits within a clinic grouping. (Sixty percent represents the technical component of the CHAMPUS fee.)

LAB: The number of laboratory procedures ordered during a visit was indicated on the front of the data collection form. This number was then multiplied by a computed average cost. The average cost for laboratory was calculated by multiplying the total number of visits in the sample (516,006) by the military (MEPRS) average reimbursement per visit of $3.36. This total was divided by the actual number of procedures performed (152,982) in the sample to provide an average cost of $11.33 (see Table 4).

LABOR: The labor cost component used in the formulas consisted of a combination of salary and benefits for military and salary only for civilians. It is determined by minutes of contact time with patients. The military labor costs were derived from the Composite Standard Rates for Costing Personnel Services–Military. These composite standard rates for each grade are published annually by Department of the Army, Director of Finance and Accounting, Security Assistance and Cost and Property Accounting Division, Indianapolis, Indiana. Since data were collected across 2 fiscal years, the appropriate rate for each of the study years was used to determine labor costs. The published annual cost (salary and benefits exclusive of medical incentives) for each military pay grade was divided by 2080 (duty hours per year) to derive a basic hourly rate. This hourly rate was then divided by 60 to obtain a rate/minute scale required by this study. The Civilian Health Care Provider Composite Standard Cost Rates were derived from the General Schedule Salary Tables No. 70 (FY85), No. 71 (FY86), No. 72 (FY87). These tables are published by the Office of Personnel Management, Assistant Director for Pay and Benefits, Washington, D.C. For purposes of the study, the median step level of 5 was used within each grade. The annual salary was then divided by 2087 hours (number of civilian productive hours in a calendar year) to derive a basic hourly rate. The hourly rate was then divided by 60 to obtain a rate/per minute scale.

RX: An average cost per prescription ordered was calculated based on the available MEPRS data. The MEPRS cost is spread over all visits without taking into consideration whether a

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prescription was actually ordered for a particular visit. In order to use the more specific visit services which were contained in the ACDB, it was necessary to compute an average cost per prescription and multiply this by the number of prescriptions ordered for a particular visit. The computations for obtaining the average cost employ the MEPRS average rate per visit ($5.43) multiplied by the total number of visits (516,006). The result was the total reimbursement ($2,801,912.00). This total rate was divided by the actual number of prescriptions (264,070) filled to determine average cost per unit ($10.61) (Table 4).

X-RAY: The charge for this service was obtained by using 39% of the CHAMPUS rate for those procedures contained in the CPT-4 code range of 70002-79999. Since X-ray procedures have such a wide range of costs ($27.30 for a plain film to $661.00 for a CT Scan), it was decided that a percentage rather than the flat military (MEPRS) rate would be more appropriate. The total reimbursement was calculated by multiplying the number of visits (516,006) in the sample by the average MEPRS reimbursement per visit ($2.49) for a total reimbursement of $1,284,854.90. This was divided by the number of plain films (55,308) for an average military reimbursement of $23.23 per plain film. This ratio ($23.23/$59.52) of military to CHAMPUS was 39%. This percentage was applied to all radiological procedures including high technology procedures like MRI, CT Scan, etc.

TABLE 4: Laboratory And Prescription Average Costs

	TOTAL VISITS	COST PER VISIT	TOTAL COST	N OF PROC	PER UNIT
LAB	516,006	$3.36	$1,733,780.00	152,982	$11.33
RX	516,006	$5.43	$2,801,912.00	264,070	$10.61

Other Special Cost Considerations

The inclusion of x-ray costs in the study formulas presented a special challenge to the study group as only the number and the general types of x-rays were included in the data collection instrument (e.g., plain films, CT scan). To capture the cost of this important aspect of medical care, a staff physician assigned a CPT-4 x-ray procedure code to each clinic. The decision to assign a particular code to a clinic was based on the most common type of x-ray for that clinic.

Some of the CPT-4 procedure codes used in the study had no corresponding CHAMPUS costs. In order to use these codes, the physician assigned to the team selected a related CPT-4 code to substitute for costing purposes.

The Pain Clinic presented another situation which required special treatment. Because of the specificity of the data collection form, duplication of documentation for injections sometimes occurred. To correct this double counting, an algorithm was written which grouped certain CPT-4 procedures together and assigned a cost based on the most expensive procedure.

Summary of Cost Methodology

In summary, the ACES team developed cost methodologies using a variety of sources (e.g. CHAMPUS prevailing rates, MEPRS cost data) to calculate resource utilization for each military health care visit. The development of each equation was an effort to accurately account for costs involved in a medical visit in a military health care setting.

The four cost methodologies, with descriptions follow. The first formula primarily uses military costs, the second, civilian costs. The two remaining formulas represent partial costs. COST3 captures military labor, and COST4 contains reimbursable costs in the current military system.

Cost Formulas

A brief explanation of each costing methodology follows:

$COST1 = FACCOMP + X-RAY + LAB + RX + LABOR.$

This equation is a combination of actual and estimated military costs. This formula represents the most accurate estimate of military costs for a military visit.

$COST2 = CHAMPUS\ PROCEDURE\ RATE.$

The CHAMPUS procedure rate consisted of the total charges (100% of CHAMPUS rate) for each type of office visit, (e.g. brief, intermediate and comprehensive) and 100% of the CHAMPUS rate for X-rays and Laboratory procedures.

$COST3 = Provider\ Labor\ Only.$

This costing methodology accounts for only the cost of the provider time for a visit. The value of time provided by the health care professional was based on the mean salary and benefits determined by the Government Accounting Office for the particular rank and grade. No attempt was made to include the various specialty pay and bonuses provided to physicians.

$COST4 = (.055\ multiplied\ by\ CLEMAN) + X-RAY + ANCILLARY + LAB + RX.$

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COST4 represents the sum of reimbursable costs as they currently exist in the Army Medical Department. It includes a computed military supply cost. The 5.5% of the CLEMAN represents this computed supply cost. This percentage was derived with the assistance of Herb Fillmore, New York State Department of Public Health. The 5.5% military supply cost per procedure compares favorably with the supply cost developed and utilized for reimbursement by the New York State Department of Health. The supply costs are based on the average procedure costs for a particular clinic.

Correlation Among Cost Methodologies

There are a number of methods available to determine the relationship among cost methodologies. The most meaningful methodology examines the amount of variance accounted for by each of the cost equations. The relationship among the cost methodologies is provided in Table 5. COST1 and COST3 are highly correlated (.8) largely because of the fact that COST1 includes COST3. COST1 and COST4 are moderately correlated (.5). Much of this correlation may be the result of the common variables shared by both, including x-ray, prescription, and laboratory costs. COST2 has a low correlation (.2-.3) with the military derived cost formulas. COST3 and COST4 have the lowest correlation (.1). This may be expected since there are no common variables and many procedures require no supplies (e.g., psychotherapy). Although all correlations are statistically significant ($p<.05$), this may be due to the large sample size (516,006). Therefore, it may be more appropriate to consider the magnitude of the correlation.

**TABLE 5: Relationship Among Cost Methodologies
           Correlation Coefficient**

(N = 516,006)

COST	1	2	3	4
1	1.000			
2	0.3959	1.000		
3	0.8024	0.33?	1.000	
4	0.5360	0.231?	0.1286	1.000

p<.05 in all cases.

User Friendliness

One focus of the ACES evaluation of any ambulatory grouper program is user friendliness, i.e., the ease of installation and use of the program. It should be noted that the ACES team had

two highly experienced and capable computer programmers and the use of a state-of-the art mainframe computer. The ACG developers provided the ACES team with mainframe and PC versions of the ACG grouper program. The ACG software was in a period of "pilot testing" that was projected to last until December 1993. The team programmers ran identical data through both the mainframe and the PC program as a test. Both versions created the same results. The variables required in the grouper were gender, age and diagnosis, making the preparation of input simpler than other groupers the team has evaluated. Unlike other grouping systems, the ACG grouper examines individual patients over an interval of time. The input data therefore needed to be sorted by patient ID. The result was an ACG code per unique patient.

Clinical Evaluation

The distribution of ACGs across clinics was examined and the resulting profiles were consistent with clinical expectations. For example 40% of the patients seen in allergy clinics were assigned to ACG 6, Likely to Recur, with Allergies, 7% were assigned to ACG 7, Asthma, 4% to ACG 22, Acute Minor + likely to recur disease, age > 5, with allergies. Internal Medicine patients had the following ACG designations: 35% to ACG 9, Chronic Medical, Stable, 22% to ACG 41, 2-3 Other ADG Combos, Age> 34, and 10% to ACG 8, Chronic Medical, Unstable.

An output file of 8180 "Bad ICD-9-CM" codes which belonged to 7411 unique patients was produced by the ACG grouper. However, these 7411 patients did group to an ACG. The term "Bad ICD" codes refers to bonified ICD-9-CM codes that are not used for the grouping algorithm. Because the ICD-9-CM list used in the grouping algorithm is incomplete, a number of erroneous ADG/ACG assignments were made. These assignments usually resulted in underestimating the morbidity level of the patient. For example, there were 303 instances in which the diagnosis of 279.10 Immunodeficiency with predominant T-cell defect, unspecified, was made. Because the grouping algorithm does not use this ICD-9-CM code, these patients were assigned to ADGs and ACGs based on other diagnoses, or to ACG 51, no diagnoses/no ADGs if 279.10 was the only diagnosis in the record. Examples of other "Bad ICD" codes that were quite significant in terms of patient morbidity are 200.00 Reticulosarcoma, unspecified site, 159.0 malignant neoplasm of intestinal tract, part unspecified, 896.0 Traumatic amputation of foot (complete), 753.2 Congenital obstructive defects of renal pelvis and ureter, 198.3 Secondary malignant neoplasm of brain and spinal cord, 295.10 Schizophrenia, disorganized type, unspecified, 297.1 Paranoia, 750.5 Congenital hypertrophic pyloric stenosis.

There appears to be some problems with the assignment of diagnoses to ADGs. For example, there were many patient episodes with the diagnosis V62.9 Unspecified psychosocial circumstance

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which was assigned to ADG 23 Psychosocial: Major and subsequently
to ACG 14 Psychosocial, w/Psych-Major, w/o Psych-minor. The
diagnoses 309.24 Adjustment reaction with anxious mood and 309.89
Other adjustment reaction are also assigned to ADG 23. The
diagnosis code V61.1, Marital conflict, is assigned to ADG 24
Psychosocial: Other, but code V61.20 Parent-child problem is
assigned to Psychosocial: Major. The psychiatrist in the ACES
study team thought that the ACG grouper defines many minor
psychiatric problems as major and that the rule for
distinguishing between what is minor and major are difficult to
discern. Similar inconsistencies in assignment of nonpsychiatric
diagnoses to major and minor categories also exist. For example
code 003.0 Salmonella gastroenteritis is assigned to ADG 2, Time
Limited: Minor--Primary Infection. ICD-9-CM code 003.9
Salmonella infection, unspecified is assigned to ADG 4, Time
Limited: Major--Primary Infection. ICD-9-CM code 004.9
Shigellosis, unspecified is assigned to ADG 2. These assignments
appeared questionable to the physician team member and
consultation with a gastroenterologist confirmed that all three
conditions should be assigned to ADG 4 as they represent major
infections.

The terminology used in ACG titles is misleading in some
cases. For example, a sample patient was assigned to ACG 35
Acute Minor + LRDis + Psychosocial. This patient had the
following diagnoses: 279.10 immunodeficiency with predominant T-
cell defect, unspecified, 536.9 unspecified functional disorder
of stomach, 0980 acute gonococcal infection of lower
genitourinary tract, V723 gynecological exam, and 625.9
unspecified symptom associated with female genital organ. It is
not readily apparent what Psychosocial condition exists in this
patient as there are no psychosocial-type diagnoses. A review of
the ADG assignments reveals 536.9 is assigned to ADG 25
Psychophysiologic. ADG 25 falls into CADG (collapsed ADG) 10
Psychosocial/Psychophysiologic that falls into MAC 10 of the same
name. However, the final ACG name drops the psychophysiologic
component and contains only the psychosocial component leading
one to believe that the grouper made an erroneous assignment.

Statistical Analysis

The analysis of variance (ANOVA) is the statistical technique
which has been used by most grouper developers and evaluators to
test the hypothesis that the grouper creates intragroup (within)
homogeneity and intergroup heterogeneity. Applying analysis of
variance to this kind of data requires care in interpreting the
results. An important consideration is the manner in which the
data is prepared before grouping. The assumptions underlying the
use of parametric statistical methods (such as analysis of
variance) are: a) each sample is a random sample from the
corresponding population and observations from different
populations are independent, b) the measurement variable is

normally distributed in each of the populations, c) the
populations all have the same variance. In reality, all
assumptions are rarely satisfied and violation of assumptions per
se is an insufficient reason to reject parametric statistical
procedures. For example, tests and intervals for normal means
are relatively insensitive to nonnormality while variances are
much more sensitive. Special techniques for investigating the
assumption of a normally distributed population include testing
for skewness and kurtosis. After the sample was run through the
grouper program the resulting groups were used as the independent
variables and the ACES cost formulas as the dependent variable.
In an effort to reduce the effects of outliers (extreme
variability) the logarithmic values were used rather than the
original values. Table 6 demonstrates the amount of skewness and
kurtosis before and after logarithmic transformation of the cost
variables. As is readily seen, logarithmic transformation of the
cost variables enables a closer approximation to the assumption
of normality.

TABLE 6:   Characteristics Of The Year Sample Cost Distribution
           After Grouping With The ACG Grouper Program.
           (51 ACG groups, 260,518 episodes of care)

COST VARIABLE	MEAN SKEWNESS	MEAN KURTOSIS
COST 1	6.6303	174.5538
LOG COST 1	0.1860	0.1836
COST 2	5.7689	100.5059
LOG COST 2	0.5632	0.3401
COST 3	5.4354	94.0305
LOG COST 3	0.1251	0.2371
COST 4	2.6958	15.3447
LOG COST 4	0.1215	-0.2498

Because the ACES study team was tasked with the evaluation of
a number of ambulatory grouping programs that used a variety of
data preparation techniques in their development, it was decided
to perform these data preparation techniques in an iterative
fashion for each grouper. Trimming of outliers is a method used
to minimize the impact of nonnormal distributions on analysis of
variance. The developers of the ACGs did not trim outliers in
the sample from which they developed the grouping program. Other
developers of ambulatory grouping programs have trimmed data to
varying degrees. For example in the development of the Emergency
Department Groups (EDGs) outliers were trimmed to 3 standard
deviations on either side of the mean; (Camereon, 1989, 1990)
while the Ambulatory Patient Groups (Averill, et. al. 1990) used
various trimming methods to include 2 standard deviations on
either side of the mean.

The ability of the ACG grouper to predict resource consumption was studied using analyses of variance techniques. The relationships between the ACG category and a variety of dependent variables were examined. The dependent variables included cost (using ACES cost formulas), logarithms of cost, total number of ambulatory visits, total number of diagnoses made in the year, and total number of unique ADGs. Table 7 presents the ACG ability to explain variance in ACES costs and logarithmically transformed costs.

TABLE 7: Total Variance Explained By The ACGs Using ACES Costs And The Log Costs As Dependent Measures.

COST VARIABLE	R-SQUARE	COEFFICIENT OF VARIATION
COST 1	0.3259	127.7065
LOG COST 1	0.4491	17.6770
COST 2	0.3464	119.5153
LOG COST 2	0.4669	14.4187
COST 3	0.3229	134.8011
LOG COST 3	0.4283	32.7053
COST 4	0.3531	110.6911
LOG COST 4	0.4491	17.6770

Table 7 demonstrates that the use of log costs improved the amount of variance explained by a 4-12% depending on the formula and the smaller coefficient of variation indicates a substantial decrease in the dispersion in comparison to the mean. The grouper explains from 32% to 35% of the variance using the ACES cost formulas and from 39% to almost 47% of the variance in resource consumption when using the ACES log cost formulas.

Table 8 presents the analysis of variance with outliers trimmed to 3 standard deviations. It should be remembered that unique patient episodes are trimmed and the impact of such trimming may be much more significant than in visit-based grouping programs. The ACG developers do not advocate trimming.

TABLE 8: Total Variance Explained By The ACGs Using ACES Costs And The Log Costs As Dependent Measures, Outliers Trimmed To 3 Standard Deviations From The Mean.

COST VARIABLE	R-SQUARE	C V	# TRIMMED PATIENT EPISODES
COST 1	0.4380	100.0558	676
LOG COST 1	0.4544	17.4749	676
COST 2	0.4390	99.8899	1436
LOG COST 2	0.4844	13.9991	1436
COST 3	0.4072	111.5185	855
LOG COST 3	0.4347	32.2799	855
COST 4	0.3677	108.0262	462
LOG COST 4	0.4009	29.4904	462

More liberal trimming of outliers to 2 standard deviations from the mean results in r-square values that are impressive, but the cost of trimming is the deletion of up to nearly 13,000 unique patient episodes. The results of this analysis are presented in Table 9.

TABLE 9: Total Variance Explained By The ACGs Using ACES Costs And The Log Costs As Dependent Measures, Outliers Trimmed To 2 Standard Deviations From The Mean.

COST VARIABLE	R-SQUARE	C V	# TRIMMED PATIENTS EPISODES
COST 1	0.5446	81.0898	12,466
LOG COST 1	0.5053	15.5606	12,466
COST 2	0.5525	81.4149	9,815
LOG COST 2	0.5370	12.8730	9,815
COST 3	0.5253	87.9465	12,931
LOG COST 3	0.4869	28.2013	12,931
COST 4	0.4488	95.3328	7,327
LOG COST 4	0.4453	28.1880	7,327

The visit count (number of visits per patient episode) was used as a measure of resource consumption and as the dependent variable in an analysis of variance analysis. The resulting r-square value was 0.5032, indicating that the ACG designation accounts for 50% of the variance in terms of the number of visits.

The level of morbidity measured by the diagnosis count (i.e., the number of diagnoses assigned to a patient) could be used as a dependent variable. Using the diagnoses as a dependent variable, an analysis of variation was repeated on the ACG groups using the

diagnosis count as the dependent variable.

The r-square value was 0.71 meaning that the ACG designation accounts for 71% of the variance in the number of diagnoses. The number of unique ADGs into which the patient was categorized during the year period explained 60% of the variance in utilization, measured by number of visits for the year. The number of unique ADGs explained from 29-37% of the variance of the ACES assigned costs and 43 to 53% of the variance in log costs. The ability of the ACG assignments determined in a baseline period to account for variance in the number of visits in a subsequent period was assessed.

DISCUSSION

The ACES evaluation of the ACGs focused on four issues: a) clinical evaluation, b) user friendliness (programming and administrative issues), c) statistical analysis of the grouper results, and d) military applicability.

Clinical Evaluation

The ACGs are conceptually simple. The ACG approach to patient classification is based on the level of morbidity and expected resource consumption of the population under study. The ACGs cluster together similar conditions based on their likelihood of persistence, recurrence, specialty referral, diagnostic and procedural procedures, hospitalization, disability, and decreased life expectancy. The ACGs appear conceptually sound, however there are some problems with the grouper algorithm that limit the clinical evaluation of the grouper. One problem is the incomplete ICD-9-CM list used in the grouper algorithm which caused erroneous ADG/ACG assignment, usually causing underestimation of morbidity level. As mentioned earlier in the report, many significant and serious ICD-9-CM diagnoses with high levels of morbidity/mortality are ignored by the grouper algorithm. Thus, one recommendation for improvement is to revise the list of ICD-9-CM codes used for the grouping algorithm to include significant diagnoses in the Bad ICD list. The deletion of these codes causes situations in which individuals with serious malignancies, injuries, and immunodeficient states are erroneously assigned to ADGs which indicate lesser levels of morbidity or in many cases to ACG 51, no ADGs. Many major psychiatric diagnostic groups are not included in the 5,000 ICD list and thus are not used in the grouping algorithm. These include most psychoactive substance disorders, some psychotic disorders, and most organic mental disorders. Dementia, including Alzheimer's disease, is also not included. Another problem with the ACG grouper, according to the psychiatrist team member, is that it defines many minor psychiatric problems as major, and the rules for distinguishing between what is minor and what is major are difficult to discern.

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This problem affects ADGs 23 and 24. It is recommended that the ACG developers review and revise the criteria for assignment of ICD-9-CM codes to ADGs 23 and 24. Problems with these ADGs cause erroneous patient assignments to ACGs 13, 14, 15, 25, 26, and 27. The terminology used in ACG titles is misleading in some cases. The titles of ACGs arising from MAC 10, 17, 21, and 23 should be revised as the use of the term psychosocial to describe psychophysiologic condition is misleading.

User Friendliness

The ACG grouper program exists in PC and mainframe versions. The PC version was tested with a file of 87,000 records which it processed without problem. All other analyses were performed on the mainframe version that handled almost 800,000 records without problem. The variable requirements are very simple: age, sex, and ICD-9-CM diagnoses. The input data had to be sorted by patient identification code that was a simple programming step. The input data then becomes an episode of care for unique patients. The ACG program grouped all unique patients presented to it. The ACES programmers found the grouper to be quite easy to use.

Statistical Analysis

Each patient episode was assigned to an ACG. The total cost of the episode was determined using the four ACES cost formulas. The ANOVA procedure was used to assess the relationship between the ACG category and a variety of dependent variables which included cost (using ACES cost formulas), total number of ambulatory visits, total number of diagnoses made in the year. The relationship between the total number of unique ADGs and the dependent variables of visit count, costs and log costs was studied. Table 10 presents the results of these analyses and demonstrates that the ACG grouper performs as well as described by the developers and is quite powerful in explaining variance.

TABLE 10: Summary Of Total Variance Explained By ACGs

DEPENDENT MEASURES

	NUMBER VISITS	COSTS	LOG COST	NUMBER DIAGNOSES
51 ACGs same year	0.50	0.35 - 0.44	0.43 - 0.47	0.71
# UNIQUE ADGs	0.60	0.29 - 0.37	0.43 - 0.53	

Military Applicability

The application of any ambulatory classification system in the military setting presents significant problems. The ACGs are intended for use in enrolled populations. They are also unique in that they would require gathering data for a period of time, ideally one year, to create a baseline measure of patient morbidity. This measure would then be used to predict resource consumption of that patient population for the coming year. The current method of entering ambulatory visit data in the outpatient medical record is inadequate for the purposes of a prospective payment system. For example, the Statistics Section of the Patient Administration Division of Brooke Army Medical Center (BAMC) reports that for fiscal year 91, BAMC had an average of 2,222 outpatient visits per day. This means there would be an average of over 2,000 records each day requiring data extraction. Compared to an average of 53.2 inpatient dispositions per day requiring data extraction for the purposes of DRG assignment. The implementation of an automated system for the gathering data is essential before the use of any ambulatory patient classification system. The ACDB study found that providers were often reluctant to duplicate their documentation requirements. A single system is required so that providers do not have to duplicate information on patient records and on data collection instruments for grouper use. The variable requirements for the ACGs are very simple, i.e., age, gender, and diagnoses. Clinic support personnel could collect patient demographic information. Retrospective review of medical records to glean diagnoses and to attach the appropriate ICD-9-CM code could not reasonably be performed as it would require huge numbers of trained personnel to accomplish the task with all the associated expense of training, salaries, etc. The ACDB required providers to record diagnoses on a bubble form with a diagnostic menu which contained some ICD-9-CM codes and some extended codes. The ACES study experience with civilian contract professional coders who were tasked with recoding the extended codes to ICD-9-CM was less than ideal because of the multiple coding errors which occurred (procedures more than diagnoses). Providers are the best coders if the mechanics of coding are simple and not time consuming.

There are automated record systems on the market with simple input requirements, such as a menu of the common ICD-9-CM diagnoses tailored to each clinic or specialty requiring a stylus check or mouse click. The providers note can be entered and a printout can be produced for the patient's record. The information is stored in the instrument for later retrieval. These types of systems should be evaluated and tested for military use. The automated record system could be tailored for each clinic/specialty in order to address other issues such as clinician dissatisfaction with ICD-9-CM. For example, some ICD-9-CM terminology is difficult for psychiatrists because of their

tendency to use the terminology contained in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R is the current edition). However, the DSM maintains coding consistency with ICD-9-CM. Most psychiatrists would prefer to chose diagnoses from a list using DSM-III-R (or updated versions) terminology and ICD-9-CM alphanumeric codes.

The ACGs do not require CPT codes (procedure codes). However, costing methodologies commonly use CPT or other standardized procedure codes to determine the cost of an ambulatory visit. Military providers tend to be unfamiliar with CPT coding and would have to be trained to become proficient in the use of CPT codes if procedures were used in military cost methodology.

Another software package is being developed for mainframe or PC use which take the output of the ACG grouper and assign calculated weights for each ACG in a manner similar to the DRG weights used in the inpatient setting. Average weights would be developed for an entire system, but local variations from the average could be determined. This could be a useful tool for higher level commands in making decisions about staffing and funding military treatment facilities. There is a packet being developed for physicians which gives greater detail about the ICD-9-CM codes within each ACG/ADG.

CONCLUSION

The Ambulatory Care Groups System is conceptually simple, user friendly, and has simple variable requirements (age, sex, diagnoses) which are gathered in some form in every ambulatory visit. The ACG grouper algorithm should be modified to classify the majority of ICD-9-CM diagnoses so that patient morbidity level can be more accurately classified. The assignment of diagnoses to ADGs should be reviewed and revised (especially ADGs 23 and 24). The titles of ACGs arising from MAC 10, 17, 21, and 23 should be revised as the use of the term psychosocial to describe psychophysiologic condition is misleading. With these corrections the ACGs should have application for research as well as management and resource allocation.

The implementation of any prospective payment system for ambulatory care would be more difficult than that experienced with the DRGs in the inpatient setting. Experience and use of diagnostic and procedural coding in the ambulatory setting is limited. Currently, hospital-based ambulatory clinics lack the ability to link departmental cost and billing data to patient clinical data. Hospital outpatient departments (OPDs) would have to develop automated systems to link financial and clinical data, and become proficient at diagnostic coding (and CPT coding for other classification systems or for cost methodologies). An automated ambulatory medical record would have to be developed which contained the necessary information in the required form (diagnosis, age, sex, etc.). This record should require one-time documentation of essential information.

The meaningful implementation of any outpatient payment system, for the military or civilian community, would require the development of a standard costing methodology. The developers of patient classification systems use standard coding such as CPT-4 codes and ICD-9-CM codes in an effort to develop patient groups that are clinically meaningful. However these systems are to be used for resourcing/payment systems. The development of standardized costing methodology which accurately captures the cost of ambulatory care is more critical. Charge based methodology provides inaccurate measures of cost. Without accurate cost methodology the reliability of any ambulatory classification system cannot be accurately assessed.

APPENDIX A: List Of Ambulatory Diagnostic Groups

NUMBER	AMBULATORY DIAGNOSTIC GROUPS
1	Time Limited: Minor
2	Time Limited: Minor—Primary Infections
3	Time Limited: Major
4	Time Limited: Major—Primary Infections
5	Allergies
6	Asthma
7	Likely to Recur: Discrete
8	Likely to Recur: Discrete—Infections
9	Likely to Recur: Progressive
10	Chronic Medical: Stable
11	Chronic Medical: Unstable
12	Chronic Specialty: Stable—Orthopedic
13	Chronic Specialty: Stable—Ear, Nose, Throat
14	Chronic Specialty: Stable—Eye
15	Chronic Specialty: Stable—Other
16	Chronic Specialty: Unstable—Orthopedic
17	Chronic Specialty: Unstable—Ear, Nose, Throat
18	Chronic Specialty: Unstable—Eye
19	Chronic Specialty: Unstable—Other
20	Dermatologic
21	Injuries/Adverse Effects: Minor
22	Injuries/Adverse Effects: Major
23	Psychosocial: Major
24	Psychosocial: Other
25	Psychophysiologic
26	Signs/Symptoms: Minor
27	Signs/Symptoms: Uncertain
28	Signs/Symptoms: Major
29	Discretionary
30	See and Reassure

APPENDIX A: (continued)

31	Prevention/Administrative
32	Malignancy
33	Pregnancy
34	Dental

APPENDIX B: "Collapsed" Ambulatory Diagnostic Groups With Assigned ADGs'"

CADG	ASSIGNED ADGs
1 Acute: Minor	1 Time Limited: Minor 2 Time Limited: Minor—Primary Infections 21 Injuries/Adverses Effects: Minor 26 Signs/Symptoms: Minor
2 Acute: Major	3 Time Limited: Major 4 Time Limited: Major—Primary Infections 22 Injuries/Adverses Effects: Major 27 Signs/Symptoms: Uncertain 28 Signs/Symptoms: Major
3 Likely to Recur	5 Allergies 7 Likely to Recur: Discrete 8 Likely to Recur: Discrete—Infections 20 Dermatologic 29 Discretionary
4 Asthma	6 Asthma
5 Chronic Medical: Unstable	9 Likely to Recur: Progressive 11 Chronic Medical: Unstable 32 Malignancy
6 Chronic Medical: Stable	10 Chronic Medical: Stable 30 See and Reassure
7 Chronic Specialty: Stable	12 Chronic Specialty: Stable—Orthopedic 15 Chronic Specialty: Stable—Other
8 Eye/Dental	14 Chronic Specialty: Stable—Eye 34 Dental
9 Chronic Specialty: Unstable	16 Chronic Specialty: Unstable—Orthopedic 17 Chronic Specialty: Unstable—Ear, Nose, Throat 18 Chronic Specialty: Unstable—Eye 19 Chronic Specialty: Unstable—Other
10 Psychosocial/ Psychophysiologic	23 Psychosocial: Major 24 Psychosocial: Other 25 Psychophysiologic
11 Prevention/Administrative	31 Prevention/Administrative
12 Pregnancy	33 Pregnancy

MAJOR AMBULATORY CATEGORIES (MACs)	CADGs ASSIGNED
1 Acute: Minor	CADG-1
2 Acute: Major	CADG-2
3 Likely to Recur	CADG-3
4 Asthma	CADG-4
5 Chronic Medical: Unstable	CADG-5
6 Chronic Medical: Stable	CADG-6
7 Chronic Specialty: Stable	CADG-7
8 Eye/Dental	CADG-8
9 Chronic specialty: Unstable	CADG-9
10 Psychosocial/Psychophysiologic	CADG-10
11 Prevention/Administrative	CADG-11
12 Pregnancy	CADG-12
13 Acute: Minor and Major	CADG-1 & CADG-2
14 Acute: Minor and Likely to Recur	CADG-1 & CADG-3
15 Acute: Minor and Chronic Medical: Stable	CADG-1 & CADG-6
16 Acute: Minor and Eye/Dental	CADG-1 & CADG-8
17 Acute: Minor and Psychosocial/Psychophysiologic	CADG-1 & CADG-10
18 Acute: Major and Likely to Recur	CADG-2 & CADG-3
19 Acute: Minor and Major and Likely to Recur	CADG-1, 2, & 3
20 Acute: Minor and Likely to Recur and Eye/Dental	CADG-1, 3, & 8
21 Acute: Minor and Likely to Recur and Psychosocial	CADG-1, CADG-3 & CADG-10
22 Acute: Minor and Likely to Recur and Chronic	CADG-1, 2, 3, & 6
23 Acute: Minor and Major and Likely to Recur and Medical: Stable Psychosocial	CADG-1, 2, 3, & 10
24 All other combinations of CADGs not listed above	ALL OTHER LISTED
25 No visit or No ADG	NO CADGS

ACGs Group Number	Ambulatory Care Groups (ACGs) Title or Description
1	Acute Minor, Age <2
2	Acute Minor, Age 2-5
3	Acute Minor, Age 6+
4	Acute Major
5	Likely to recur w/o Allergies
6	Likely to recur with Allergies
7	Asthma
8	Chronic Medical, Unstable
9	Chronic Medical, Stable
10	Chronic Specialty Stable
11	Ophthalmological/Dental
12	Chronic Specialty, Unstable
13	Psychosoc, w/o Psych. Major
14	Psychosocial, w/Psych-Maj, w/o Psych-Min
15	Psychosocial, w/Psych-Maj, w/Psych-Min
16	Preventive/Administrative
17	Pregnancy
18	Acute Minor + Acute Major
19	AcuteMI + LRDis, Age <2
20	AcuteMI + LRDis, Age 2C5
21	AcuteMI + LRDis, Age >5 w/o Allergy
22	AcuteMI + LRDis, Age >5, w/ Allergy
23	Acute Minor + Med Stable
24	Acute Minor + Eye/Dental
25	Acute-Min + Psychosoc, w/o Psych-Maj
26	AC-Min + Psychosoc, w/ Psych-Maj, w/o Psych-Min
27	AC-Min + Psysoc, w/Psych-Maj, w/Psych-Min
28	Acute Major + Likely to Recur Discrete
29	Acute MI _ Acute MA + LRDis, Age <2
30	Acute MI + Acute MA + LRDis, Age 2-5
31	Acute MI + Acute MA + LRDis, Age 6-11

32	Acute MI + Acute LRDis Age >5 w/o allergy
33	Acute MI + Acute MA + LRDis, Age >5 w/allergy
34	Acute MI + LRDis + Eye/Dental
35	Acute MI + LRDis + Psychosocial
36	Acute MI + Acute MA + LRDis + Eye/Dental
37	Acute MI + Acute MA + LRDis + Psychosocial
38	2-3 Other ADG Combos, Age <17
39	2-3 Other ADG combos, Males Age 17-34
40	2-3 Other ADG combos, Females Age 17-34
41	2-3 Other ADG Combos, Age >34
42	4-5 Other ADG Combos, Age <17
43	4-5 Other ADG Combos, Age 17-44
44	4-5 Other ADG Combos, Age >44
45	6-9 Other ADG Combos, Age <6
46	6-9 Other ADG Combos, Age 6-16
47	6-9 Other ADG Combos, Males Age 17-34
48	6-9 Other ADG Combos, Females Age 17-34
49	6-9 Other ADG Combos, Age >34
50	10+ Other ADG Combos
51	No Visits and/or No ADGs

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